Laryngoscopy: Time to broaden our horizon.

Dr.Renu Devaprasath, D.N.B. (Anesthesia),
Dept of Anesthesia,
Dr.Jeyasekharan Medical Trust,
Nagercoil,

Abstract

Failure to secure the airway & maintain oxygenation continues to be a cause of significant morbidity & mortality in anaesthetic practice, emergency medicine and critical care, and research goes on to find the perfect solution.

Laryngoscopy occupies a unique position in anaesthesia because it is a procedure which is only a means to an end. The ultimate aim is to safely and atraumatically intubate the trachea and secure the airway. Rarely, visualizing the upper airway, vocal cords, removing a foreign body or placing a R.T or TEE probe may necessitate a laryngoscopy.

Direct Laryngoscopy for airway management has remained the dominant modality since its introduction in the 1940's. But, because this procedure needs the alignment of the visual, oral and laryngeal axis it may result in an unsuccessful or impossible intubation at times.

State of art devices incorporating optical, fiberoptic and video technology have now become available to augment the function of direct laryngoscopy.

This presentation attempts to give a bids eye view of the range of techniques, manouvers and devices currently available to the anaesthesiologist to secure the airway under vision.

Introduction

Direct laryngoscopy is still the favoured, fastest, most economical means of visualizing the laryngeal opening and intubating the trachea but because of the occasional failures to secure the airway in some cases the last 15 years have seen a proliferation of devices that have been designed to assist in intubating the difficult airway.

The advantage of most of these devices is that the laryngeal opening can be visualized indirectly. The need to align the visual, oral, pharyngeal and laryngeal axis is eliminated and reduced mouth opening is sufficient with less cervical spine movement.

This presentation will be limited to laryngoscopy in anaesthesia practice leaving aside the diagnostic and therapeutic uses that direct, indirect, flexible and video laryngoscopy may have in other specialities.

The primary objective of laryngoscopy is intubation of the trachea. Hence each factor involved in this procedure needs consideration to broaden our horizon of laryngoscopy. The variables are:-

1. The airway anatomy of the patient

2. The size of the patient.

3. The equipment or device used to do the laryngoscopy.

4. The positioning of the head and neck in relation to the body.

5. Cervical spine movement.

6. Adequacy of mouth opening.

7. External pressure on the larynx.

8. Viewing of the glottic aperture.

9. Passing the ETT into the trachea.

10. Adequate analgesia ± muscle relaxation +calm or anaesthetized patient.

11. Experience of the anaesthesiologist.

Difficulty with any one or more of these variables may result in a unsuccessful laryngoscopic intubation.

Some of these variables are fixed for a particular patient, then the selection of the device becomes very important whereas in others change of maneuvers, techniques and practice may result in success.

1.Variations in airway anatomy

The airway anatomy of the patient may be distorted due to congenital or acquired problems.

These are a frequent cause of a difficult direct laryngoscopy as the tissues may not be pliable enough or may be distorted to allow alignment of the visual, oral and laryngeal axis.

This variation is usually picked up on airway assessment and the anaesthesiologist can electively select a appropriate laryngoscope from those available. Namely:

a. Direct laryngoscopes

b. Optical stylets

c. Indirect fibreoptic rigid laryngoscopes

d .Video laryngoscopes

e. Flexible fibre optic endoscopes.

2. Size of the patient

For small babies and neonates, small size direct laryngoscope straight blades, with reduced web height are available to allow visualizing of the anteriorly placed larynx with the long epiglottis and also for giving more space for passing the ETT.

In babies with difficult airways[1]

The Shikani optical stylet (SOS) , The Bonfils Endoscope, Glidescope Cobalt, Storz Miller video laryngoscope, Airtraq optical laryngoscopes and the Truview are available. The latest high definition Flexible Fibreoptic endoscope comes in a size of 2.7mm allowing use of small ETTs.

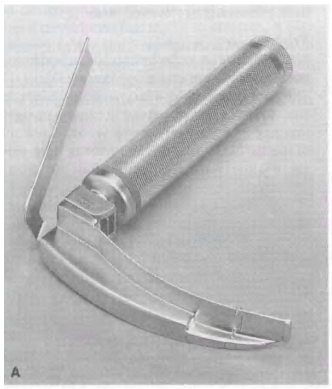
3. The laryngoscope

The broad classification of the types of laryngoscopes available with some details of the newer devices shall be presented.

i. Direct Rigid laryngoscopes with blades like the Macintosh and Miller are familiar to all and they come in various sizes. Some, like the flexible tip McCoy blade and short handle scope are useful in improving the view. There are innumerable other blades[2] and the choice rests with the anaesthesiologist.

Laryngoscope handles

Reusable handle with curved (Macintosh) & straight (Miller) blades



Curved flexible tip laryngoscope (McCoy)

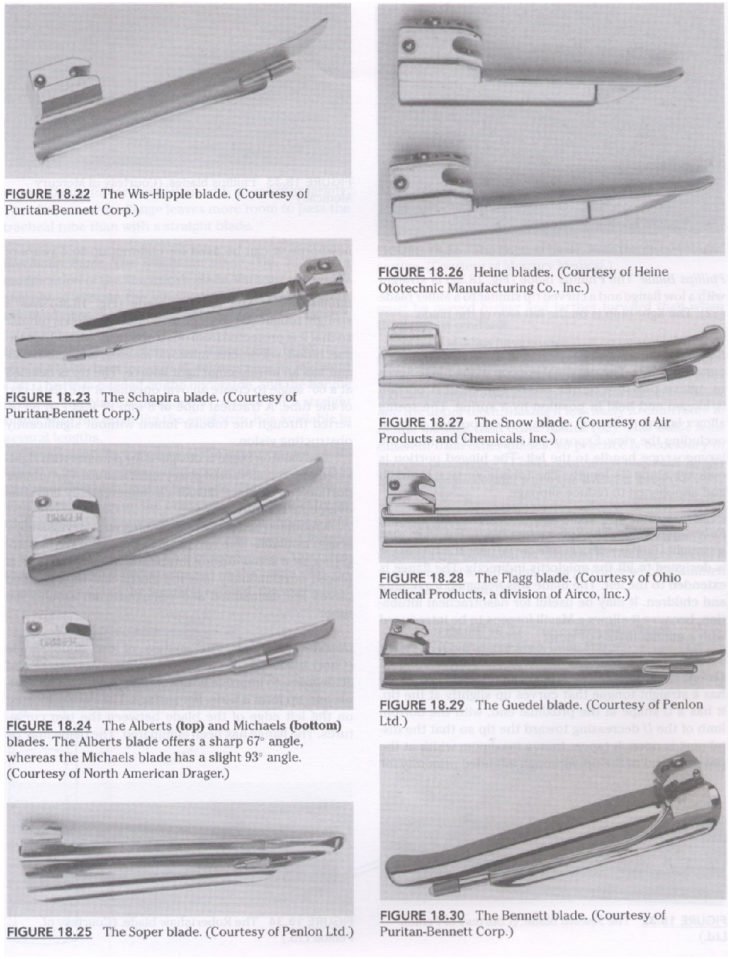


FIGURE 18.22 The Wis-Hipple blade. (Courtesy of Puritan-Bennett Corp.)

FIGURE 18.23 The Schapira blade. (Courtesy of Puritan-Bennett Corp.)

FIGURE 18.24 The Alberts **(top)** and Michaels **(bottom)** blades. The Alberts blade offers a sharp 67° angle, whereas the Michaels blade has a slight 93° angle. (Courtesy of North American Drager.)

FIGURE 18.25 The Soper blade. (Courtesy of Penlon Ltd.)

FIGURE 18.26 Heine blades. (Courtesy of Heine Ototechnic Manufacturing Co., Inc.)

FIGURE 18.27 The Snow blade. (Courtesy of Air Products and Chemicals, Inc.)

FIGURE 18.28 The Flagg blade. (Courtesy of Ohio Medical Products, a division of Airco, Inc.)

FIGURE 18.29 The Guedel blade. (Courtesy of Penlon Ltd.)

FIGURE 18.30 The Bennett blade. (Courtesy of Puritan-Bennett Corp.)

Other blades

ii. Indirect Rigid Fibreoptic laryngoscopes

Rigid fibre optic laryngoscopes are designed to approximate the anatomy of the upper airway and to provide indirect fibre optic visualization of the laryngeal inlet[3]. Examples include:

a. Bullard laryngoscope

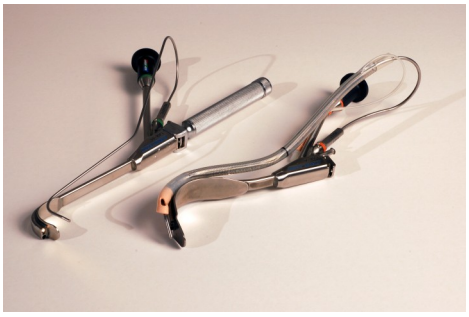
b. Wuscope

c. Upsherscope

These laryngoscopes do not need to align the visual, oral and laryngeal axis hence are useful in patients with limited neck movement, reduced mouth opening, morbidly obese patients etc. Technique of use is similar to direct laryngoscopy. The major difficulty in using rigid fiberoptic scopes is the inability to visualize the larynx incase of the presence of blood, secretions, vomitus etc.

a) Bullard laryngoscope-Available in adult and pediatric sizes. Intubation is quick and discomfort is lesser compared to direct laryngoscopy in awake intubations. Atleast 2cm occlusional mouth opening is needed for achieving intubation. The introducing stylet or multifunctional stylet is needed for intubating. A extension tip is available for larger patients but the literature has reported two instances where it has got detached leading to airway problems[4].

The author's advice caution regarding use and to always check presence of the extender tip on removal of the scope.



Bullard laryngoscope

b) Wuscope – combines a rigid tubular 3 piece blade (handle, mini blade, bivalve element) with a flexible fiberscope. A laryngoscopy in performed with the left hand viewing through the eye piece of the flexible scope and the ETT is placed via the channel provided for the purpose.

Wuscope

Specific advantage of the Wuscope is that the tubular blade protects the fiber optic lens from blood, secretion and soft tissues[3].

c) Upsherscope – A rigid indirect laryngoscope with a C shaped blade. Corresponding to the curve of the oropharynx which is open on the right side. The distal part of the blade is more open and has a upward curve.

Upsherscope

On the left side the fiberoptic bundles transmit the light to where the C shape opening ends. The light source can be in the handle or remote and the eye piece has the viewing bundle.

The ETT is placed in the C shaped slot with its tip near the distal angulated portion.

Bougies, tracheal tube exchange catheters may be passed too.

Airtraq – A single use indirect laryngoscope which uses mirrors and prisms.

Airtraq optical laryngoscope

Truview – Rigid indirect laryngoscope using prisms to improve the view.

Truview optical laryngoscope

(iii) Optical stylets

These are relatively new in the anaesthesiologist's armamentation and are relatively easy to use since direct laryngoscopy is performed to introduce them in the midline.

a) Bonfils endoscope[1]

This is a rigid stylet laryngoscope with a curved tip. It has a adapter which stabilizes the tube and via which O2 can be supplemented.

It can accept 6 mm or larger tubes and the light source may be remote fiberoptic or batteries.

For antifogging stylet is put in warm water.

ETT is slipped over it. Tip of Bonfil should be within the ETT tip.

A direct laryngoscopy is done with a Macintosh laryngoscope and the epiglottis is lifted and glottic aperture viewed.

The ETT is slipped off into the trachea.

Bonfils endoscope

Advantage

a. Direct laryngoscopy is done hence easy to use.

b. Lesser depth of anaesthesia and lesser cervical spine movement is needed.

c. Cheaper than a flexible fiberoptic endoscope.

Disadvantage

a. Only 6 mm and larger tubes.

b. Longer time to intubation.

c. Secretion may block vision.

d. Use of O2 insufflation can lead to pneumothorax [1]

a) Shikani optical stylet (SOS)[1,3] – comes in adult and paediatric sizes which fit onto the same handle. It is malleable at the tip. There is a separate port for insufflating O2 through the stylet and there is a stopper to keep the ETT in position. The optical channel runs in the centre. Adult stylet will accept 5.5 mm and larger ETTs.

Paediatric stylet accepts size 3.5 ETT and above.

Shikani optical stylet

Advantages

a. Uncomplicated

b. Easy to learn

c. Portable, simple to prepare and use.

d. Can be used for small babies.

Disadvantages

a. Potential for impaired vision due to fogging and secretions.

b. Short optical depth.

iv.Video laryngoscopes[1,3,5]

Video assisted laryngoscopy transmits an image from a optical element located on a laryngoscope blade to a monitor. In addition to providing indirect images that may not be possible with direct laryngoscopy the image is magnified and has a wide angle view. The newer devices incorporate a small video camera in the blade. Assistance becomes appropriate since both operator and assistant view the same image. It is also a good teaching aid. The disadvantage is that these are costly and even though the glottis is viewed very clearly the intubation is awkward.

The following are currently available:-

a.Glidescope video laryngoscope [GVL]-developed in 2001.Has undergone numerous modifications and transformations.

Original Glidescope came with a black and white image .

Upgraded to colour image, blades in 3 sizes and antifogging technology.

Glidescope Ranger- a portable battery operated unit with a transreflective screen for use even in the sunlight.

Cobalt Glidescope- Uses a disposable transparent plastic blade[called The Stat] over the video baton. The video system is thus protected.

Glidescope Ranger

Cobalt Glidescope

b. McGrath Video Laryngoscope [MVL] - Developed by a British university student and named after him.

McGrath Video Laryngoscope

It has 3 main parts.

Handle- housing the battery along with the adjustable video monitor.

Camera module incorporating a light source and micro video camera.

A disposable laryngoscope blade which fits onto the camera module.

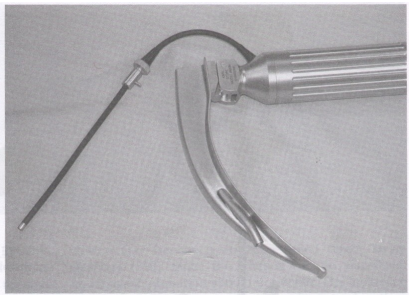
It is introduced in the midline like the traditional scope and is the most comfortable to use. The tube with a malleable stylets is shaped like a hockey stick so that intubation is easier.

c. Pentax Airway Scope AWS –S100 [PAS]

It has a channel alongside the laryngoscope blade where the ETT is loaded and guided into the trachea under vision.

Pentax Airway Scope

d. Storz Macintosh/Miller intubating laryngoscopes – Fiberoptic bundle is introduced into the blade up to 2/3 length.



Storz Macintosh intubating laryngoscope[1]

e. Airtraq Optical laryngoscope with video-uses mirrors and lenses for visualizing the glottic aperture through a curved optical channel.It is battery operated and has a channel for the ETT on the right side. The cost is lesser and it is meant to be useful.

f) Angulated video intubation laryngoscope (AVIL) - Has a channel to introduce a flexible fiberscope upto the blade tip.

The view can also be seen on the video monitor unit.

Angulated video intubation laryngoscope

Disadvantages of video laryngoscopes

a. High initial investment

b. The blades are usually angulated and the position of the glottic aperture is anterior to the image viewed by direct laryngoscopy hence even though the view of the laryngeal inlet is very good, passing the endotracheal tube may not be easy.

Flexible fibreoptic endoscopes

These are the most versatile laryngoscopes in difficult airway situation.

Flexible fibreoptic endoscopes

Advantages

i. These endoscopes come in various sizes allowing intubation of neonates, babies and adults.

ii. Flexible fiberoptic intubation can be performed comfortably in awake, sedated or anaesthetized patients.

iii. Glottic view can be obtained irrespective of variation in anatomy, immobilization of cervical spine.

iv.Laryngoscopy can be done in the absence of mouth opening via the nose.

Disadvantages

1. High initial cost
2. The fibres and cables are delicate and need to be handled carefully at all times
3. Learning takes a little time and effort.
4. The introduction of the endotracheal tube into the trachea is a blind procedure.
5. In the event of severe oedema and presence of blood the view is obscured.

4.Positioning of the head and neck in relation to the body.

Popitz pillow, Pi's pillow, The Troop Elevation pillow and folded sheets can be used to modify this variable.

5.Cervical spine movement

When there is fixed restriction or in line immobilization.

Various rigid laryngoscopes like McCoy or Rigid Indirect fibreoptic scopes like Bullards, or Optical stylets, Bougies or flexible scopes can be used.

6.Adequacy of mouth opening.

Restriction may be fixed as in TM Joint Ankylosis or mandibular condylar fractures with impaction or may be due to spasm associated with pain.

Use of muscle relaxants will enable adequate mouth opening in patients with spasm, whereas in the others laryngoscopy can be performed by flexible fibreoptic endoscope.

7.External pressure on the larynx[3]

BURP – Backward Upward Rightward Pressure

OELM – Optimal External Laryngeal Manipulation .

These manouvres are very useful and can improve the laryngoscopic view significantly in many patients.

8.Viewing of the glottic aperture.

Optic, fibreoptic and video technology has improved the view immensely. Unfortunately it does not ensure successful intubation.

9. Passing the endotracheal tube into the trachea. This may be helped by

i.Modifying the shape of the tube using a malleable stylet

ii.Using a Bougie or Airway exchange catheter to first enter the trachea and then thread the ETT over it.

iii. In case of flexible fibreoptic intubation the following manouvres come handy.

Rotatory motion of the tube, rotating the ETT 90º in the anticlockwise direction so that the bevel faces backwards.

Selecting the size of ETT and endoscope so that the tube is just a little larger than the scope.

10. Appropriate analgesia / Anaesthesia for laryngoscopy and intubation.

i. For Direct laryngoscopy – Good depth of anaesthesia and relaxation are needed.

ii. Indirect Rigid Fibre optic laryngoscopy –The sympathetic response is a lesser than for direct laryngoscopy.

iii. Optical stylets – Needs lesser depth of anaesthesia

iv. Flexible fibre optic laryngoscopy – can be done with patients awake, under topical anaesthesia, sedation or under general anaesthesia on spontaneous ventilation.

Muscle relaxation is not advisable while using flexible fiberoptic endoscope for intubation.

11.Experience of the anaesthesiologist.

Meticulous attention to detail for every routine laryngoscopy is advisable to avoid panic under difficult situations.

Wisdom lies in checking that every patient can be ventilated at all times.

A difficult intubation tray should be in readiness in every OR.

It is advisable that every anaesthesiologist familiarizes themselves with use of the flexible fibre optic endoscope and atleast two other devices / aids to overcome the difficult laryngoscopic intubation scenario.

Conclusion

Direct laryngoscopy likely will continue to be the initial approach to intubating the trachea. Positioning of the head, external laryngeal pressure, the use of the bougies will continue to assist. A variety of optical, rigid, flexible and video laryngoscopes now offer a distinct advantage to the anaesthesiologist to handle the difficult airway. With these advances, familiarity with some of the options and attention to details, it may well be possible to drastically reduce critical events related to laryngoscopic intubation in the practice of anaesthesia.

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